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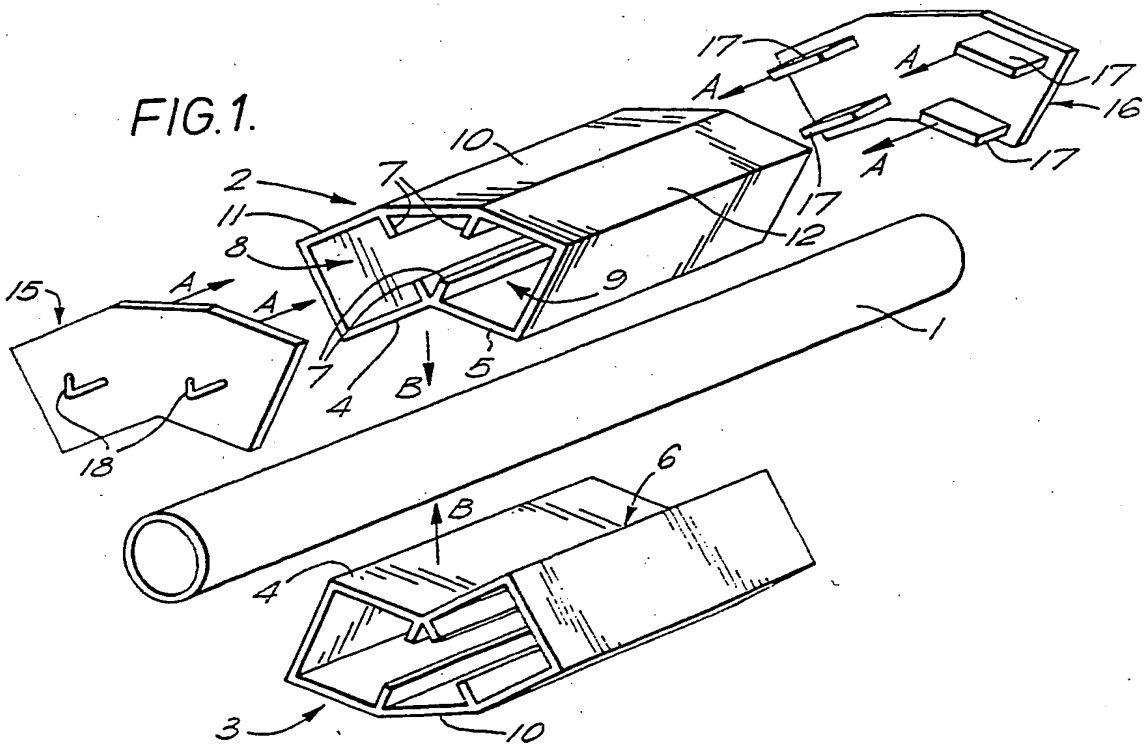
(54) Magnetic treatment of pipes and fluids therein

(57) A pipe 1 is encircled by a pair of magnet holders 2, 3 each having a pair of uPVC magnet-holding chambers 8, 9 which can be end-capped by push-fit end-caps 15, 16. In the chambers permanent magnets (13, Figure 2) e.g. of ferrite, are positioned so that the encircled section of pipe is exposed across substantially all of its diameter to the magnetic field in the region of the north poles of the magnets. The magnets may have keeper plates (14) to enhance the flux density. An array of magnets may be used with some having their south poles directed towards the pipe.

The exposure of fluids to a magnetic field of entirely north polarity generated by permanent magnet leads to surprising effects, for example, a reduced tendency for hard water to scale, a reduced viscosity or hydraulic friction of water and non-aqueous fluids, and improved clinical effects in known medical uses of magnetised water.

FIG.1.



The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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FIG.1.

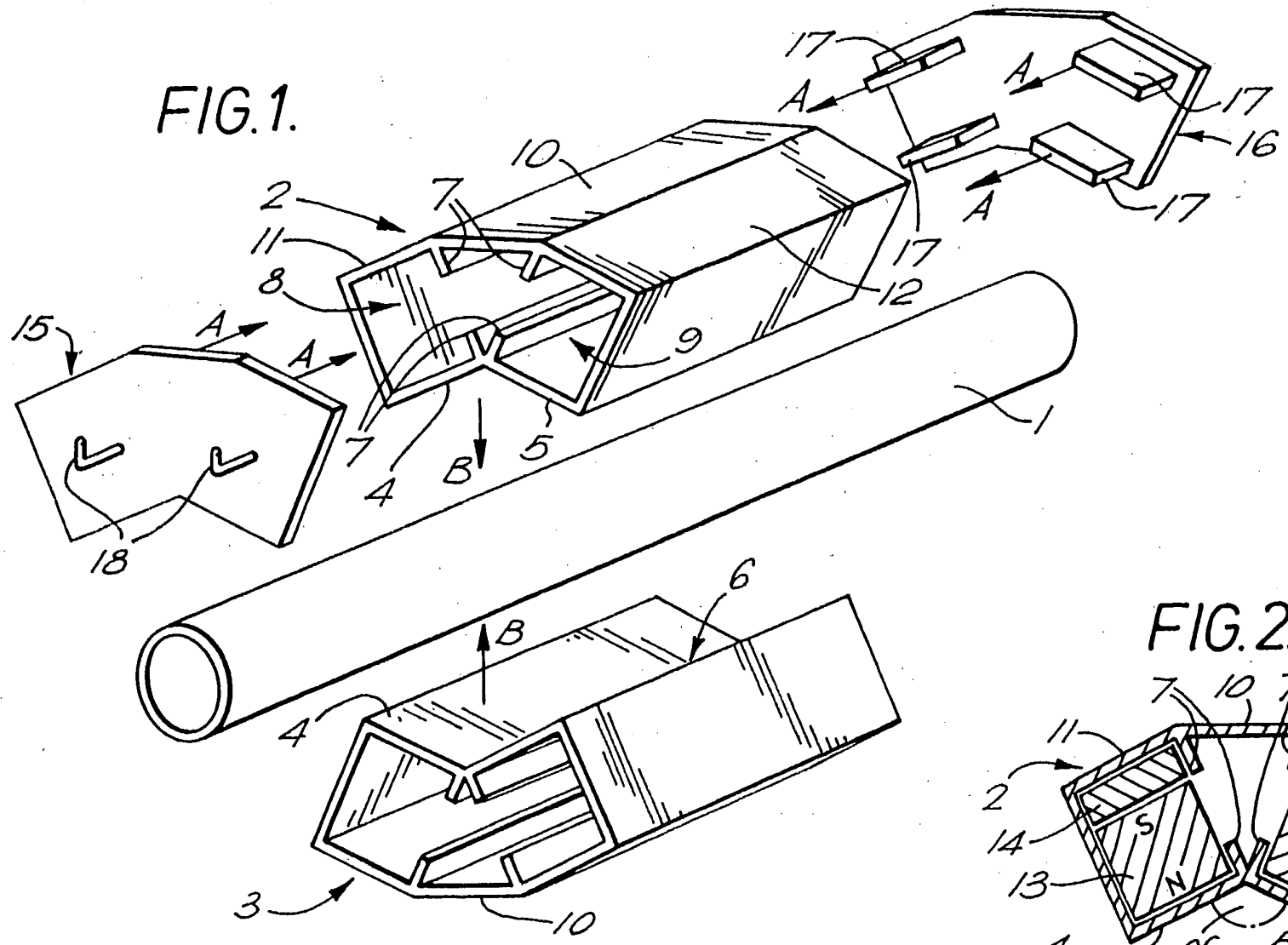

FIG.2.

MAGNETIC TREATMENT OF PIPES AND FLUIDS THEREIN

The present invention relates to the treatment of pipes and fluids therein with a magnetic field.

In the following description, the expressions "north pole" and "south pole" refer respectively to the north-seeking and south-seeking poles of a magnet, that is the poles of the magnet which are attracted respectively to the Earth's magnetic North Pole and the Earth's magnetic South Pole. The expression "fluids" includes liquids, gases and flowable solids.

According to one aspect, the invention provides a method for the magnetic treatment of a pipe and fluid therein, which comprises exposing a section of the pipe across substantially all of its diameter to the magnetic field in the region of the north poles of a plurality of permanent magnets arranged, preferably symmetrically, around the pipe.

The method has been found to surprisingly reduce the tendency for hard water to deposit "scale" in a pipe, and moreover causes existing scale to be removed by the water. The following other possible advantages of the method may particularly be mentioned:

1. regulation of acidity/alkalinity of water,
2. reduction of surface tension and viscosity of water and non-aqueous fluids such as hydrocarbons and fuel oils,
3. reduction of hydraulic friction in pipes,
4. improvement of fuel efficiency and/or energy output in internal combustion engines when the method is applied to a fuel pipe (e.g. pipes for gasoline, liquefied gases or fuel oils), and
5. medical uses such as magnetising water for

administration to patients, e.g. for dissolving concretions such as gallstones, treatment of arthritis and rheumatic diseases and problems associated with poor blood circulation.

The magnetic flux density can be selected according to the desired treatment and the fluid being treated. For use in the de-scaling of pipes carrying hard water, for example, a magnetic flux density in the range approximately 1000-2000 Gauss (0.10-0.20 Tesla), more preferably about 1400 Gauss (0.14 Tesla), may be effective.

The magnets used are preferably ceramic magnets, preferably of the hard ferrite kind which are manufactured by pressing from ferrite particles. Anisotropic grade magnets having a Curie temperature of approximately 450°C are preferred for use in the present invention, as such magnets will provide an effective field strength over a wide range of operating temperatures (e.g. up to about 350°C).

As an example of a suitable anisotropic grade ceramic magnet, the FERROBA 2 magnets manufactured by Swift Levick Magnets Limited, Sheffield, UK may be mentioned. Such magnets have a remanence of approximately 3900 Gauss (0.39 Tesla), an energy product of approximately 3.6 M.g.o. (28 kJ/m^3), a coercive force of approximately 2200 Oersted (176 kA/m) and a mean recoil permeability of 1.15. Their Curie temperature of about 450°C is acceptably high, and they have an acceptable density of approximately 4.8-5.0 g/cm^3 and relatively low cost.

The north poles of the magnets are suitably located within about 5 mm, most preferably within about 2 mm, from the external surface of the pipe. At this distance the preferred permanent magnets, of remanence approximately 3900 Gauss (0.39 T), can provide a maximum flux density across the pipe of approximately 1000-1400

Gauss (0.10-0.14 T). If desired, the higher flux density of up to approximately 1400 Gauss (0.14 T) can be achieved by overlaying the south poles of at least one (preferably all) of the magnets with metallic plates (hereafter called "keeper plates"). The materials and dimensions of the keeper plates are selected according to the degree of enhancement of the magnetic field strength required. Mild steel plates are preferred, suitably coated with a synthetic coating to prevent rusting, of thickness up to about 10 mm, suitably about 3-9 mm (e.g. approximately 6 mm) overlying the entire area of the south pole of each magnet. When particularly strong magnets are used, however, thicker keeper plates may be necessary. Most preferably, separate plates should be present, one for each magnet or discrete group of magnets.

It may also be preferable in some circumstances to provide for the creation of turbulence in the fluid in conventional manner during exposure to the magnetic field, as this can enhance the beneficial effects of the magnetic field.

In the method of the present invention other sections of pipe may if desired be exposed to magnetic fields of other polarities or combinations of polarities, in addition to the north polarity already described. In this case it is preferred that the sections of pipe exposed to the other polarities or combinations of polarities should be upstream of the section exposed to the north polarity in accordance with the invention, so that the fluid exiting from the north polarity region is not subsequently exposed to a different magnetic field.

The invention also provides an apparatus for performing the above described method, the apparatus comprising holder means locatable alongside a section of pipe, and a plurality of permanent magnets retained in the holder means in such a way that the north poles of the magnets

are directed in use mutually inwards towards the section of pipe to expose the section of pipe across substantially all of its diameter to the magnetic field in the region of the said north poles.

The holder means preferably takes the form of a plurality of extrusions each defining one or more elongate magnet-holding chambers each configured to retain therein at least one permanent magnet (and, if desired, at least one keeper plate as described above). The extrusions are shaped so that they may be arranged around a pipe to closely encircle a section of the pipe in such a way that the inwardly-directed pole of each retained magnet is within about 5 mm (more preferably within about 2 mm) of the external surface of the pipe.

As described above, to perform the method of the invention the arrangement of magnets must be such that over at least part of the length of the holder means the pipe lies in a magnetic field of north polarity. If desired, however, the magnetic field provided by the magnets at other portions of the holder means may be of south polarity or a combination of north and south, by placing all or some of the magnets in such other portions of the holder so that their south poles are directed towards the pipe.

Each magnet is preferably snugly held in its chamber to prevent it moving in the chamber. The extrusions are conveniently formed of a plastics material such as uPVC.

It is most preferred that each extrusion should define two parallel elongate chambers, each of substantially rectangular cross section and joined at an angle to each other. It is preferred that at least two such extrusions can be secured around the pipe with the pipe lying in the base of a V-channel formed by the angled join between the chambers. The magnet-holding chambers thereby made available beside the pipe can be occupied by magnets (and

if desired keeper plates) for more or less of the length of each chamber, according to the desired magnetic field strength, polarity and extent.

By careful selection of the configuration and dimensions, we have found that an extrusion defining two elongate chambers, each of substantially rectangular cross section of long side about 20 mm and short side about 15 mm, joined at an angle of about 130°. provides a high degree of versatility. In particular, two such extrusions can be placed on the standard small pipes of 15 mm, 20 mm and 22 mm diameter while maintaining an acceptably small distance between the magnets in the chambers and the pipe surface, while for larger pipes more such extrusions can be added (for example, a 2.5 inch (62 mm) diameter pipe can accommodate four such extrusions around it).

Once the apparatus according to the invention is in position alongside a pipe it is conveniently releasably secured there. In the case of elongate extruded magnet holders as described above, the ends of the chambers may conveniently be closed off with extrusion end-caps which fit to each end of the extrusions and may conveniently carry formations such as hooks over which wire or adhesive tape can be run when securing the extrusions in place against the pipe.

For further understanding of the invention, and to show how the same may be put into effect, an embodiment will now be described, without limitation and purely by way of example, with reference to the accompanying drawings, in which:

Fig. 1 shows an exploded pseudo-perspective view of an apparatus for the magnetic treatment of a pipe and fluid therein, with two of the four end-caps omitted for clarity; and

Fig. 2 shows a vertical cross-sectional view of one extruded part of the apparatus of Fig. 1, showing

two magnets and keeper plates in position.

Referring to the drawings, an apparatus is shown in a form particularly intended for the magnetic de-scaling of a pipe 1 carrying hard water.

The apparatus comprises two like magnet holders 2, 3 capable of being releasably retained to opposite sides of the pipe and each presenting a pair of radially inner walls 4, 5 for contacting the pipe, the inner faces being angled at an angle of α about 130° with respect to each other to form a channel 6 of shallow V cross-section at the base of which the pipe can lie.

Each magnet holder 2, 3 is formed of extruded plastics (e.g.uPVC) and has internal partial walls 7 defining two parallel elongate chambers 8, 9 each of like rectangular cross section integrally joined to one another at an angle to provide the desired shallow V-channel 6. The arrangement is braced by a web 10 between the radially outer walls 11, 12 of the chambers.

Each chamber 8, 9 of each holder 2, 3 retains therein a bar magnet 13 (shown only in Fig. 2 for clarity) having its north pole N directed radially inwards and its south pole S directed radially outwards. The external shape of the magnet 13 corresponds generally to the internal shape of the chambers 8, 9 save for being slightly shorter longitudinally than the chambers and also being somewhat shorter between the north and south poles than the separation between the radically inner and the radically outer walls 4, 5; 11, 12 of the chambers. The resultant gap between the south pole S of each magnet 13 and the respective outer wall 11 or 12 is occupied by a mild steel keeper plate 14 which serves to increase the magnetic flux density in the region of the pipe 1, as described above.

As an alternative (not shown) to a single magnet in any

particular chamber, an array of more than one magnet may be used to form a discrete group of magnets, although conveniently only one keeper plate would still be present in any particular chamber. Some of the magnets in such an array may if desired have their south poles directed towards the pipe 1, so long as there remains a section of the pipe 1 (preferably the section at the extreme downstream end of the holders) which is exposed only to the magnetic field in the region of north poles.

For shorter or longer magnets or arrays of magnets, the holders 2, 3 would be cut to correspondingly shorter or longer length than that illustrated, so that the magnets are snugly retained in the chambers.

To assemble the apparatus the magnets and keeper plates are slid into the chambers and a pair of like end caps 15, 16 (shown only for holder 2, for clarity) push-fitted (arrows A) in the ends of each holder to snugly retain the magnets. Each end cap carries to one side a set of projecting lugs 17 which engage into the chamber ends and fit there by friction and/or by a slight resilient restoring force bearing against the inside faces of the chamber walls 4, 5; 11, 12. To its other side each cap carries a pair of projecting hooks 18 over which a wire fastener (not shown), also passing over the corresponding hooks on the end-cap to the opposite side of the pipe, can be tightened after bringing the holders up to the pipe (arrows B) to urge and retain the holders 2, 3 together and in contact with the pipe 1.

To dismantle the apparatus the above assembly procedure is reversed.

For use in the de-scaling of a pipe 1 containing hard water, bar magnets 13 are preferably made of anisotropic grade ceramic (ferrite) having a remanence of approximately 3900 Gauss (0.39 T), for example magnets marketed under the name FERROBA 2 by Swift Levick Magnets

Limited, Sheffield, UK.

The walls of the holders 2, 3 are conveniently about 1-2 mm (e.g. about 1.25 mm) thick to allow the north pole of each magnet to lie close enough to the pipe.

FERROBA 2 magnets 13 of height (north pole to south pole) about 12.5 mm in such holders provide a magnetic flux density in the region of the pipe of about 1400 Gauss (0.14 T) when a mild steel keeper plate 14 of thickness about 6 mm is present over the south pole of the magnet. Such a flux density has been found to be particularly effective in the de-scaling of water pipes for mains water, domestic heating and shower unit de-scaling applications.

Moreover, by selecting an angle α of about 130° in the base of the V-channel 6 of the holders, as described above, and by selecting a suitable width of about 15 mm of each of radially inner wall 4, 5 (i.e. the separation of the wall between its long sides), a very versatile holder configuration is obtained whereby two or more such holders can fit with acceptable closeness around most of the standard pipe sizes currently in use.

The invention is described above without limitation and various modifications and variations will be readily apparent to those skilled in this art. All such modifications and variations are intended to be included in the scope hereof.

CLAIMS

1. A method for the magnetic treatment of a pipe and fluid therein, which comprises exposing a section of the pipe across substantially all of its diameter to the magnetic field in the region of the north poles of a plurality of permanent magnets arranged around the pipe.

2. A method according to claim 1, wherein the north poles of the permanent magnets are symmetrically arranged around the pipe.

3. A method according to claim 1 or claim 2, wherein between two and four magnets are used.

4. A method according to any preceding claim, wherein the magnetic flux density across the pipe is in the range of 1000 to 2000 Gauss (0.10 to 0.20 Tesla).

5. A method according to any preceding claim, wherein the magnets are ceramic magnets.

6. A method according to claim 5, wherein the magnets are composed of hard ferrite.

7. A method according to any preceding claim, wherein the magnets are anistropic magnets having a Curie temperature of approximately 450°C.

8. A method according to any preceding claim, wherein the south pole of at least one of the magnets is overlaid with a metallic plate to enhance the magnetic field strength in the region of the north pole of the or each such magnet.

9. A method according to any preceding claim, wherein one or more upstream sections of the pipe (relative to the fluid flow in the pipe) are exposed to magnetic fields of other polarities or combinations

of polarities.

10. A method according to any preceding claim for the treatment of fluids selected from water, gasoline, fuel oils and liquefied gases.

11. An apparatus for the magnetic treatment of a pipe and fluid therein, comprising magnet holder means locatable alongside a section of pipe, and a plurality of permanent magnets retained in the holder means in such a way that the north poles of the magnets are directed in use mutually inwards towards the section of pipe to expose the section of pipe across substantially all of its diameter to the magnetic field in the region of the said north poles.

12. An apparatus according to claim 11, wherein the holder means comprises a plurality of extrusions each defining one or more elongate magnet-holding chambers each configured to retain therein at least one permanent magnet, the extrusions being shaped so that they may be arranged around the pipe to closely encircle a section of the pipe.

13. A method for the magnetic treatment of a pipe and fluid therein, substantially as herein described with reference to the accompanying drawings.

14. An apparatus for the magnetic treatment of a pipe and fluid therein, substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

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Relevant Technical fields

(i) UK Cl (Edition L) B2J (JC,JF,JN,JO,JQ)

(ii) Int Cl (Edition 5) C02F (1/48)

Search Examiner
MR J L FREEMAN

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
1 MARCH 1993

Documents considered relevant following a search in respect of claims 1 TO 14

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	US 5024759 A (T M McGRATH & A W TILES) column 5 lines 21 to 23	1 to 3, 10 and 11
X	US 4367143 A (R K CARPENTER) All figures	1 to 3 and 8 to 11

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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